

A REVIEW ON FEASIBILITY OF PRESSURIZED IRRIGATION, IN CANAL COMMAND AREA

SHIV SINGH BASEDIYA¹, S. K. PYASI², R. N. SHRIVASTAVA³ & S. K. SHARMA⁴

¹Research Scholar, Department of Soil and Water Engineering, J.N. K. V. V., Jabalpur, India

^{2,3,4}Professor, Department of Soil and Water Engineering, J. N. K. V. V., Jabalpur, India

ABSTRACT

Indian agriculture has made a lot of progress, from the time of draught and famines to self-sufficiency in food production. Water played a major role in this achievement besides high yielding varieties, use of chemical and fertilizers. During last 4-5 decades, major emphasis was given on developing irrigation infrastructure; however there were no much attention given on the efficient utilization of created water resource. This has resulted a wide gap, between potential created and potential utilized. At the end of XII plan, 102.77 M ha was the potential created and 87.23 M ha was the potential utilized. Canal Irrigation Sector is facing a number of challenges as, irregular and inadequate water supply, water logging and salinity, unavailability of water control and measurement structures, non-adoption of irrigation methods, improper working of water user associations. Many researchers are focusing their studies on these issues and trying to find out solution. Here, a brief account of research work done by some of such scientists, which indicated that pressurized irrigation in command, is a feasible solution to improve the performance.

KEYWORDS: Canal Irrigation, Canal Command Area, Water Productivity, Water User Association & Pressurized Irrigation

Received: Sep 01, 2017; **Accepted:** Sep 21, 2017; **Published:** Nov 17, 2017; **Paper Id.:** IJASRDEC201735

INTRODUCTION

Water is the most precious natural resource and a universal asset. Care of water resource is essential in everyday life, as it is needed for survival and food production. The World's total irrigated area was 311 M ha in 2013 in which India has 21.7% share. On an average, the global consumption of water in agriculture is around 71% of the total water use, corresponding to 16% of all cultivated land and contributing to 44% of total crop production (FAO, 2015).

Madhya Pradesh, with a geographic area of about 30.8 M ha, the second largest state of India. The major land use in Madhya Pradesh is under agriculture (49.5% of geographic area), followed by forest (30.88%). The state has a sub-tropical climate and the average annual rainfall is 1160 mm (with regional variation from below 800 mm to above 1600 mm). The state has sufficient water resources and it is estimated that about 70% of water resources can be harnessed for irrigation purpose. It is possible to irrigate about 60.90 lakh ha from surface water, while 52 lakh ha can be irrigated, through ground water. Thus the state has an ultimate irrigation potential of about 121.74 lakh ha. The net irrigated area in the state including all resources of irrigation, in the year 2011-2012 was 78.80 lakh ha, which was 52.47% of the net sown area. When the above potential is harnessed, the percentage of irrigation to net sown area would be 76.80%. (NABARD 2015).

Canal Irrigation

India is among the foremost countries, in the world practicing large scale irrigation. During the post-independence period, the country has invested huge amount of capital in the major and the medium irrigation projects. The performance of major and medium irrigation schemes was examined, by the National Irrigation Commission (1972), the National Commission on Agriculture (1976) and several other committees. However, the gap between the potential created and utilized has been increasing over the years. It was found that, the available irrigation potential was not fully utilized. The difference between the available and utilized irrigation potential exceeds 4.0 M ha. Among the states, three have already achieved 70% or more of the ultimate irrigation potential with Tamilnadu, recording 100% achievement, followed by the Punjab and Rajasthan 84% and 74% respectively.(www. agricoop. nic. in).

In Madhya Pradesh tank irrigation is conventional due to its rocky and stony surface, but in recent years well (including tube well) and canal have gained popularity and account for 53% and 30.3% of the net irrigated area of the state. The Chambal project provides irrigation to 2.83 lakh hectares in Gwalior, Bhind and Morena districts. The Wien ganga canal takes off from the Wien ganga river and irrigates 4000 hectares of land in Balaghat and Seoni districts. In the state, long term planning has been done, to develop irrigation and all possible efforts are made to execute such plans. 22 major, 90 medium and 4804 minor irrigation schemes have completed till 2015. (MPWRD, Govt. of 2015).

Evaluating System Performance

Performance evaluation parameters of irrigation canal systems should involve factors such as command area, canal network, control structures, cropping patterns, weather conditions as well as human factors. An integrated simulation and optimization approach is proposed to improve the irrigation delivery system operation and management strategy. Providing optimal water levels in the main system will guarantee proper flow diversion to laterals and farm turnouts. The performance of minor irrigation project of Mehgawntola command area head been evaluated by Patidar et al. (2007). It was reported that, overall project irrigation efficiency decreased from head to tail reach of the command area. Irrigation efficiency was obtained as 75.36%, 69.80% and 62.59% at head middle and tail reach, respectively.

Yakubov (2011) stated that, irrigation performance is an important tool that irrigation service providers at various levels of the water management hierarchy, can use for monitoring, benchmarking and self-improvement. Attempt was made to explore and sensitizing farmers views, about irrigation service and related performance dimensions using qualitative research methods.

Problems in Command Area

Problems related to water release, allocation, distribution and utilization in Right Bank Canal of Samrat Ashok Sagar Project Vidisha, as obtained after survey and close interaction with water users and canal managers. In large, public irrigation schemes in Asia, the main problems of irrigation service delivery faced by the farmers were usually erratic delivery and inequity, between the heads and tail ends of the canals, resulting in low cropping intensities, in a poor proportion of the systems' command area being irrigated, and poor yields. It observed that, entire irrigation area cannot be irrigated due to deficiency of irrigation facilities, poor practices of irrigation by flooding method and socioeconomic factors in the irrigation scheme. The demand of water supply for drinking purpose put additional stress on existing distribution network, especially main canal and Right Bank Canal and its Distributary No. 2 and create conflict situation in rabi season, (Phadnis and Kulsrestha 2010). A study was conducted by Choudhury (2007), to know at the outset how the

farmers' perceive the current irrigation service delivery system. The results show that, only 69% reported canal irrigation, as the dominant source of irrigation. Only 56% of the total irrigation needs of an individual farmer were fulfilled, from the canals. Accountability of the service providers towards the farmers is currently lacking and needs major attention, in the future. Quality of the service delivery varied across different sections of the command of a system, with the tail reaches receiving the worst service, effectively shrinking the actual command.

In India WUAs and Their Role in Command Area

The impact of water user's association work related to management, operation and maintenance services in Great Menderes basin irrigation schemes had been assessed by Koc et al. (2006). Survey was carried out using the random sampling methodology, in order to investigate the opinion of water users. A questionnaire considering five different topics was used to analyze the management, operation and maintenance performance of the WUA's. The users' general opinion was that, the turnover of the irrigation infrastructure to the WUAs has had a very positive impact. Similarly, Cakmak et al. (2009), evaluated the irrigation system performances of the Water User Associations in Asartepe irrigation scheme, in Turkey. Financial Performance, productive performance and water delivery performance were determined. From the result, it was concluded that, Asartepe irrigation association is successful in decision making, on system development. Sreehari et al (2012), studied evaluation of Water User Associations functioning along Pyderu canal, Pennar delta, Nellore District, Andhra Pradesh, India. The strength and weaknesses of the functioning of WUA'S have been analyzed. Partial functioning of WUA'S in the study area has been observed from this study and many constraints have been found in effective mobilization of resources. Sangle (2016) the project level associations of Waghad saved about one-third water supplied for irrigation, apart from increasing productivity. This water has been used for additional area under irrigation. Waghad project has developed good rapport and coordination between various institutions, involving in irrigation management. This is innovative participatory water management.

Planning in Canal Command Area

Canal command area planning, plays an important role on efficient water resource management, as well as socio-economic development of the society. The methods for increasing productivity of water consumed in agriculture are improved by water supply management, which had been discussed by Sudha et al. (2008). They presented the results of an optimization study of the Malampuzha irrigation project of the Bharathapuzha river basin of Kerala in India (MILP) model, was developed and five different management strategies were tested. The result indicated that, a management strategy with deficit irrigation, by supplying less water in non-critical growth period and maximum water during stress sensitive periods was a best viable solution for better performance. A MILP Model, rather than a LP model, was used to ensure that the reservoir did not spill before reaching its capacity.

Bhuvandas et. al. (2010), used a Linear Programming (LP) model, for obtaining optimized cropping area in the command of Ukai reservoir, with the objective of maximizing the sum of the relative yields from all crops in the irrigated area for specific range of water availability like 100%, 90%, 80% and 70%. The net revenue from agricultural production were maximized for available irrigation water taking into account the sets of constraints like crop area, cropping pattern and water requirement. The model is applied to a part of Ukai reservoir system, namely Ukai Right Bank Main Canal (URBMC), in Gujarat state, India. Currently the micro irrigation methods are mainly adopted on farms with irrigation from tube wells or dug wells. However, in view of increasing scarcity of water for irrigation and need to increase food production, it is important to adopt these methods in canal command area. A linear programming model was formulated to

suggest the optimal cropping pattern under micro irrigation method in canal command areas. The model gave optimal cropping pattern for 431.7 ha of command area having water availability of 171280 m³ during the "ON" period (7 days) of canal rotation. The net returns from the optimal cropping plan were Rs.186 million. It was found that 6% increase in net benefit could be achieved through reutilization of the micro irrigation systems among the seasonal crops having similar system requirements. (Gadge et al. 2011).

Feasibility of Pressurized Irrigation in Command Area

The canal based pressurized irrigation system is a feasible option, in flow based minor irrigation system and it increases the irrigation efficiency very significantly (Shrivastava et al. 2006). The problem of turbidity of canal water can be managed by making it to pass the adjunct reservoir, catch well and a three-stage filtration process. The uniformity coefficient of sprinkler and drip irrigation system is well within the acceptable limit. Thus, the canal based drip and sprinkler irrigation system with adjunct reservoir has the potential of becoming a good way of irrigation in canal commands of minor irrigation systems in plateau areas. It was found that the irrigation efficiency of sprinkler and drip irrigation systems were 77.2% and 90.19% respectively in comparison to 46.14% in case of surface irrigation system. The uniformity coefficients of sprinkler irrigation system and emission uniformity of drip irrigation system were 81.4% and 94.2% respectively. Thus the above system can be successfully used in minor irrigation commands, for increasing irrigation efficiency as well as yields. The economic analysis of the system indicated that if the cost of hybrid drip and sprinkler irrigation system is less than Rs. 38,000.00 /ha, then saving water through this system will be more economical. Later Shrivastava et al. (2010), presented a study on feasibility of pressurized irrigation in canal command area. They planned to provide pipe conveyance and surface irrigation, for rice cultivation during monsoon season and pressurized irrigation, during post monsoon period, through a hybrid system of sprinkler and drip with four outlets for sprinkler, irrigating 2.8 ha area and two outlets for drip irrigating 1.9 ha area. To take care of sediment in the canal water, there were three stages of filtration: first by hydro cyclone filter which filters heavy suspended materials viz. sand, silt, etc., then by the sand filter and finally by the screen filter. The filtration at three stages reduces the turbidity to the desired level. The benefit-cost ratio of the system was found to be 1.126. A study conducted by Nema and Shrivastava (2012), reported that in Lalpur minor of Rani Avanti Bai Sagar (RABS) Project only 105 ha, out of 210 ha was receiving proper irrigation and rest of the area was almost unirrigated. After intervention of sprinkler irrigation, area increased by 90 ha towards the tail end and efficiency, and water productivity increased as compared to head reach.

In India, most of the irrigation networks are unlined and huge amount of the irrigation water is lost in main canal, distributary, minors and field channels. Study done by Rathod and Shah (2013) stated that, about 71% of the irrigation water is lost in the whole process of its conveyance from head works and application in the field. The breakup of the losses is main and branch canal (17%), distributaries (8%), water courses (20%) and field losses of 27%. The situation is particularly bad in minor irrigation systems of plateau areas of eastern India, where the overall irrigation efficiency varies between 20 to 35%. In 2010, only about 35% of agricultural land in India was reliably irrigated. About 66% cultivated land in India is dependent on monsoons. These systems are located in coarse soil area and have rolling topography. Most of the major irrigation command areas in India suffer from problems of inadequate and unreliable water supply.

Improving Water Productivity

The composite timing system in north Gujarat, to analyze the applied water productivity in daily production analyzed by Kumar (2014).. It also analyzed the extent to which groundwater use in the region can be reduced without

compromising on the farm economy and milk production through efficient irrigation water use technologies using a simulation model based on linear programming. To summarize, past research on water productivity were on analyzing average physical productivity of water for select crops, including variation according to climate.

The water use efficiency and water productivity of different vegetable crops, paddy crops grown under open well command and bore well command has been analyzed by Sethi et al (2014), on the basis of crop yield data and irrigation water, used by the crops and crop ET for the growing season. Conjunctive use planning of irrigation through bore well, dug wells and ponds on farmers' participatory approach in tail reach of the canal command areas could increase cropping intensity from 151% to 300% with high value and less water requirement crops.

CONCLUSIONS

The studies gone through in this paper highlighted the various problems on command area and also discussed various aspects to evaluate the irrigation project their planning and remedial measures. There were suggestion made to tackle the issues and efficient utilization of water resources. The studies are concentrated on the problems and suggested remedial measures. These measures are adopted in some places fully and some places partially. It revealed from these studies that use of pressurized irrigation in command area may be a solution to get efficient water utilization and to improve water productivity.

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